US008009858B2

(12) **United States Patent**
Cobb

(10) **Patent No.: US 8,009,858 B2**
(45) **Date of Patent: Aug. 30, 2011**

(54) **LOUDSPEAKER**

(76) Inventor: **Jason Myles Cobb**, Odessa, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 944 days.

(21) Appl. No.: **11/987,362**

(22) Filed: **Nov. 28, 2007**

(65) **Prior Publication Data**

US 2009/0136078 A1 May 28, 2009

(51) **Int. Cl.**
H04R 1/02 (2006.01)
H04R 7/00 (2006.01)
H04R 25/00 (2006.01)
H04R 31/00 (2006.01)

(52) **U.S. Cl.** **381/423**; 381/182; 381/184; 381/186; 381/396; 381/424; 381/432; 181/163; 29/594

(58) **Field of Classification Search** 29/594; 181/163; 381/182, 184, 186, 396, 423, 424, 381/432
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,844,787	A *	2/1932	Newill	381/432
2,231,479	A *	2/1941	Perry	381/186
2,496,589	A *	2/1950	Firth	381/186
3,116,377	A *	12/1963	Todt	381/407
3,213,209	A *	10/1965	Doelitzsch	381/186
4,239,943	A *	12/1980	Czerwinski	381/404
4,477,699	A *	10/1984	Wada et al.	381/184
4,595,801	A *	6/1986	Coffin	381/424
4,965,839	A *	10/1990	Elieli	381/339
5,295,194	A *	3/1994	Christensen	381/190
5,548,657	A *	8/1996	Fincham	381/182
6,111,969	A *	8/2000	Babb	381/396
6,212,284	B1 *	4/2001	Puls	381/345
6,466,676	B2 *	10/2002	Coffin	381/186
6,963,650	B2 *	11/2005	Combest	381/182
7,809,148	B2 *	10/2010	Cobb	381/186
7,848,533	B2 *	12/2010	Cobb	381/186
2002/0071588	A1 *	6/2002	Proni	381/403
2003/0185415	A1 *	10/2003	Funahashi et al.	381/398
2005/0008188	A1 *	1/2005	Harris	381/404
2005/0244031	A1 *	11/2005	Nevill	381/407

* cited by examiner

Primary Examiner — Elvin G Enad
Assistant Examiner — Christina Russell
(74) *Attorney, Agent, or Firm* — Stephen R. Greiner

(57) **ABSTRACT**

A loudspeaker including a frame and a toroidal magnet that is affixed to the rear of the frame. The toroidal magnet has a central passageway that opens into the frame. A cap is affixed to the rear of the magnet and closes the central passageway. A guide rod is affixed to the cap and projects forwardly from the cap into the central passageway. A tubular former is slidably positioned upon the guide rod. A voice coil is wound about, and is affixed to, the tubular former. A driver plate is affixed to the front of the tubular former. A resilient surround connects the periphery of the driver plate to the front of the frame. A suspension assembly resiliently connects the tubular former to the frame and has a pair of conical diaphragms that are secured together so as to form a bellows. A spider connects the bellows to the frame and another spider connects the bellows to the tubular former.

3 Claims, 2 Drawing Sheets

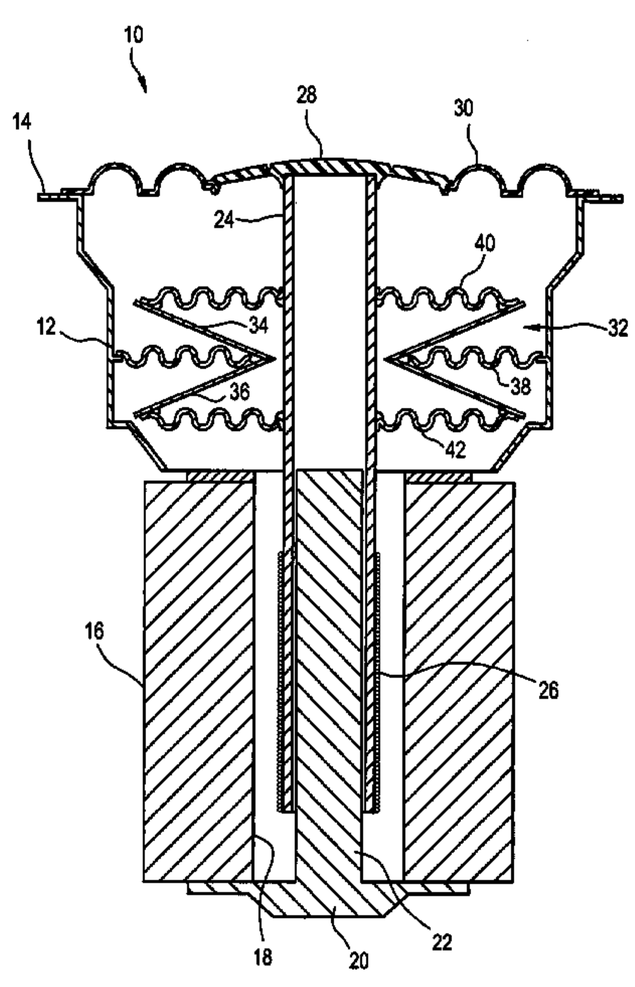


FIG. 1

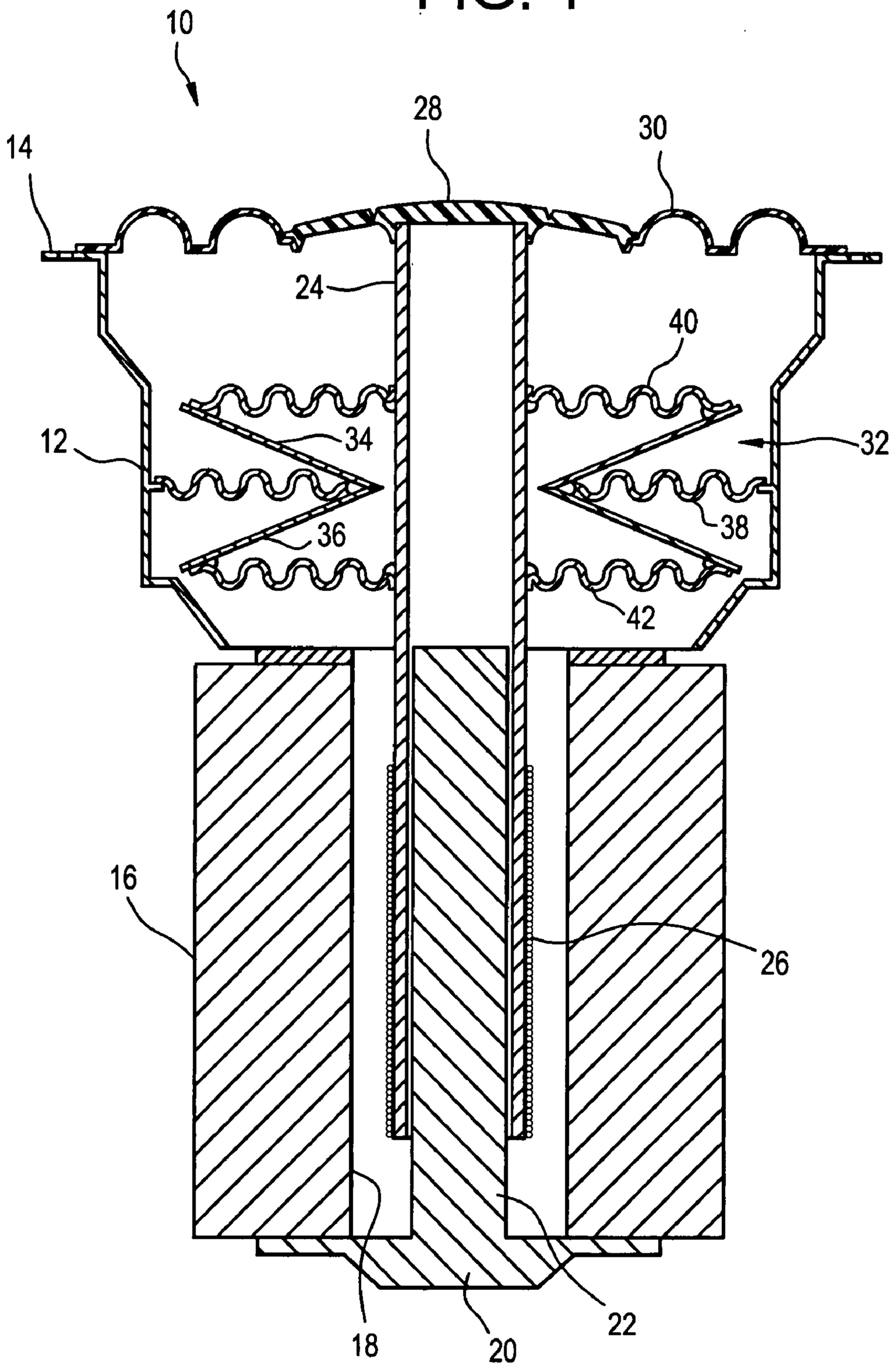
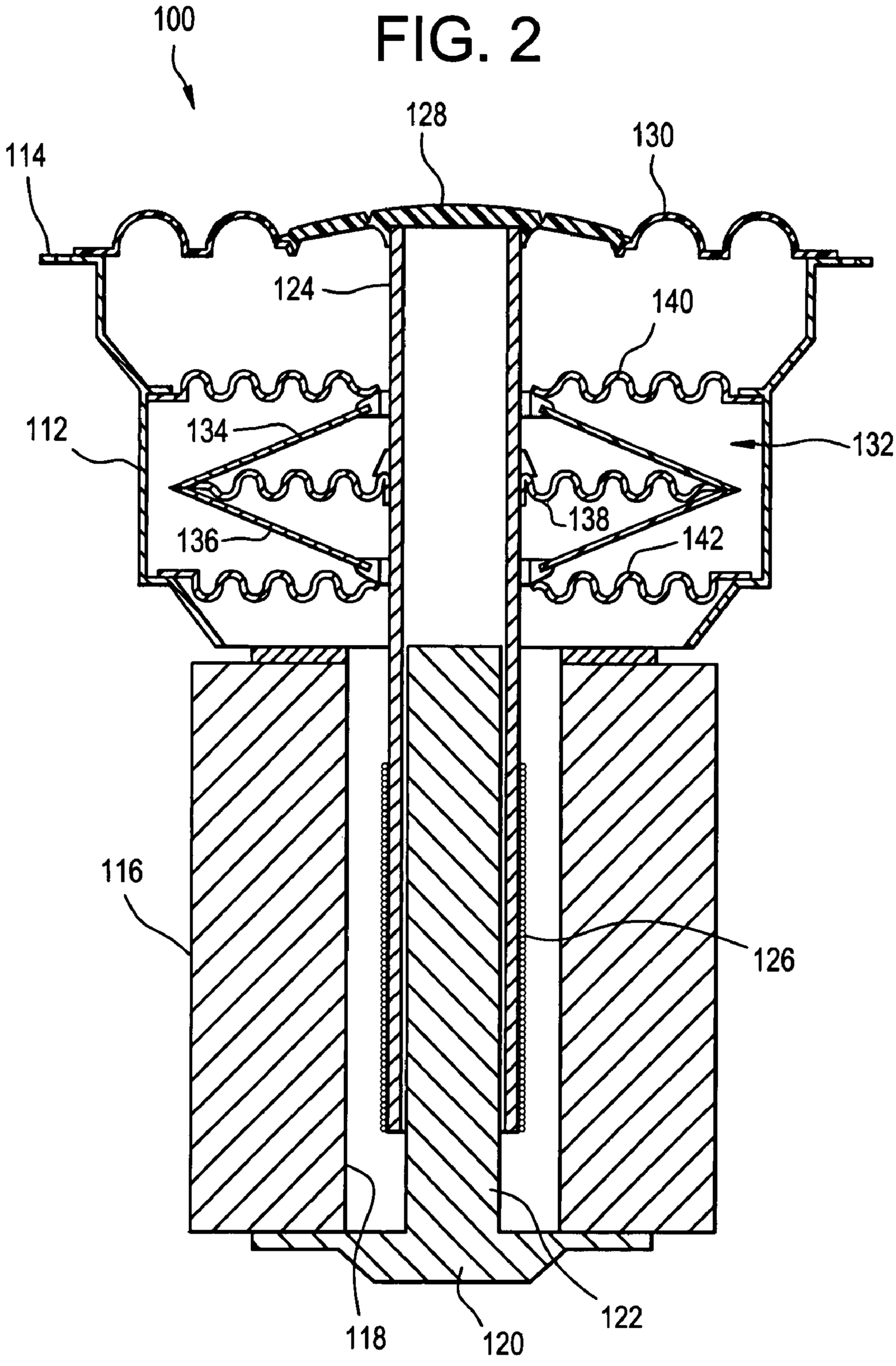


FIG. 2


100
128
130
114
124
140
112
134
132
138
136
142
116
126
118
120
122

LOUDSPEAKER

FIELD OF THE INVENTION

The present invention relates generally to electrical audio signal processing systems and devices and, more particularly, to electro-acoustic audio transducers having plural diaphragms.

BACKGROUND OF THE INVENTION

A conventional loudspeaker has a cone that is vibrated over a range of frequencies to generate audible sounds. Typically, a corrugated device called a "spider" is secured to the periphery of the cone to maintain the cone's position before, during, and after, sound-producing vibrations are induced. The spider permits the cone to move forwardly and rearwardly from its resting position with the full range of motion being known as "peak-to-peak excursion." As the peak-to-peak excursion of a cone increases, so does its ability to produce louder sounds, especially at lower frequencies.

Peak-to-peak excursion of a loudspeaker cone is often made larger by increasing the diameter of the spider attached to the cone and by increasing the diameter of the cone. Unfortunately, the small cabinets or other enclosures that are used to contain a loudspeaker place limits on the sizes of cones and spiders. Thus, the sound produced by many loudspeakers is less than satisfactory in terms of its quality and its volume.

SUMMARY OF THE INVENTION

In light of the problems associated with known loudspeakers, it is a principal object of the invention to provide a loudspeaker that features a pair of conical diaphragms, secured together so as to form a bellows, that maximize the peak-to-peak excursion of a driver plate without increasing either loudspeaker size or power requirements. Also, the conical diaphragms move air like the driver plate, effectively increasing loudspeaker output. Thus, loudspeaker sound volume limits can be increased at minimal cost in space-restricted situations.

Another object of the invention is to provide a loudspeaker of compact size that can exceed the output, in terms of volume, frequency range, and quality, of a substantially larger loudspeaker of conventional construction.

It is an object of the invention to provide improved features and arrangements thereof in a loudspeaker for the purposes described that is lightweight in construction, inexpensive to manufacture, and dependable in use.

The foregoing and other objects, features, and advantages of the present loudspeaker will become readily apparent upon further review of the following detailed description of the preferred embodiments as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

My invention can be more readily described with reference to the accompanying drawings, in which:

FIG. **1** is a vertical, cross-sectional view of a loudspeaker constructed in accordance with the present invention.

FIG. **2** is a vertical, cross-sectional view of an alternate loudspeaker constructed in accordance with the present invention.

Similar reference characters denote corresponding features consistently throughout the accompanying drawings.

DETAILED DESCRIPTION OF THE LOUDSPEAKERS

Referring now to the FIG. **1**, a loudspeaker in accordance with the present invention is shown at **10**. Loudspeaker **10** includes a conical frame **12** having an outwardly extending, peripheral, mounting flange **14** at its wide, front end and, also, having a narrow, rear end to which is affixed a toroidal magnet **16** with a central passageway **18** that opens into frame **12**. A cap **20** is affixed to the rear end of magnet **16** that closes passageway **18**. A guide rod **22**, integrally formed with cap **20**, projects forwardly from cap **20** and through passageway **18**. A tubular former **24** is slidably positioned upon rod **22** in the annular space located in passageway **18** between rod **22** and magnet **16**. A voice coil **26** is wound about, and is affixed to, former **24** yet is spaced away from magnet **16**. A rigid, driver plate **28** is affixed to the front end of former **24** and projects radially outward therefrom. The periphery of plate **24** is affixed, by means of a resilient, ring-shaped surround **30**, to flange **14**. A suspension assembly **32** further secures former **24** to frame **12** and includes a pair of conical diaphragms **34** and **36** that are connected together at their respective narrow ends through which former **24** freely passes. The connected, narrow ends of diaphragms **34** and **36** are secured to frame **12** by a corrugated, medial spider **38**. The wide, forward end of diaphragm **34** is secured to former **24** by a corrugated, forward spider **40**. The wide, rearward end of diaphragm **36** is secured to former **24** by a corrugated, rearward spider **42**. A pair of electrical leads (not shown) delivers an electrical current to voice coil **26** thereby making coil **26** into an electromagnet.

In FIG. **2**, an alternate embodiment of my loudspeaker can be seen at **100**. Loudspeaker **100** includes a conical frame **112** having an outwardly extending, peripheral, mounting flange **114** at its wide, front end and, also, having a narrow, rear end to which is affixed a toroidal magnet **116** with a central passageway **118** that opens into frame **112**. A cap **120** is affixed to the rear end of magnet **116** that closes passageway **118**. A guide rod **122**, integrally formed with cap **120**, projects forwardly from cap **120** and through passageway **118**. A tubular former **124** is slidably positioned upon rod **122** in the annular space located in passageway **118** between rod **122** and magnet **116**. A voice coil **126** is wound about, and is affixed to, former **124** yet is spaced away from magnet **116**. A rigid, driver plate **128** is affixed to the front end of former **124** and projects radially outward therefrom. The periphery of plate **128** is affixed, by means of a resilient, ring-shaped surround **130**, to flange **114**. A suspension assembly **132** secures former **124** to frame **112** and includes a pair of conical diaphragms **134** and **136** that are connected together at their respective wide ends positioned near frame **112**. The connected, wide ends of diaphragms **134** and **136** are secured to former **124** by a corrugated, medial spider **138**. The narrow, forward end of diaphragm **134**, through which former **124** freely passes, is secured to frame **112** by a corrugated, forward spider **140**. The narrow, rearward end of diaphragm **136**, through which former **124** freely passes, is secured to frame **112** by a corrugated, rearward spider **142**. A pair of electrical leads (not shown) delivers an electrical current to voice coil **126** thereby making coil **126** into an electromagnet.

The use of loudspeakers **10** and **110** is straightforward. To use loudspeaker **10**, voice coil **26** is cyclically energized so as to cause former **24** to vibrate longitudinally at predetermined frequencies. Driver plate **28** and diaphragms **34** and **36**, being matched in terms of their sound production characteristics, respond simultaneously to the frequencies at which former **24** vibrates. Surround **30** and spiders **38-42** serve to return

former **24** to its original position when deflected by the action of coil **26**. Similarly, in loudspeaker **110**, voice coil **126** is cyclically energized so as to cause former **124**, driver plate **128** and diaphragms **138-142**, to vibrate. Surround **130** and spiders **138-142** serve to return former **124** to its original position when deflected by the action of coil **126**. The result in both loudspeakers **10** and **110** is the production of audible tones (particularly those having a low frequency) of high volume.

While loudspeakers **10** and **110** have been described with a high degree of particularity, it will be appreciated by those skilled in the art that modifications can be made to them. Thus, it is to be understood that the present invention is not limited to loudspeakers **10** and **110**, but encompasses any and all loudspeakers within the scope of the following claims.

I claim:

1. A loudspeaker, comprising:

a frame;

a toroidal magnet being affixed to the rear of the frame, the toroidal magnet having a central passageway that opens into the frame;

a cap being affixed to the rear of the magnet and closing the central passageway;

a guide rod being affixed to the cap and projecting forwardly from the cap into the central passageway;

a tubular former being slidably positioned upon the guide rod;

a voice coil being wound about, and being affixed to, the tubular former;

a driver plate being affixed to the front of said tubular former;

a resilient surround connecting the periphery of said driver plate to the front of said frame; and,

a suspension assembly for resiliently connecting said tubular former to said frame, said assembly including:

a pair of conical diaphragms being secured together so as to form a bellows;

a first spider connecting said bellows to said frame; and,

a second spider connecting said bellows to said tubular former.

2. The loudspeaker according to claim **1** wherein each of said conical diaphragms has a narrow end and a wide end and said conical diaphragms are secured together at the wide ends thereof and wherein said loudspeaker further includes:

a pair of said first spiders, each connecting said narrow end of a respective one of said conical diaphragms to said frame; and,

said second spider connecting said wide ends of said conical diaphragms to said tubular former.

3. The loudspeaker according to claim **1** wherein each of said conical diaphragms has a narrow end and a wide end and said conical diaphragms are secured together at the narrow ends thereof and wherein said loudspeaker further includes:

a pair of said first spiders, each connecting said wide end of a respective one of said conical diaphragms to said tubular former; and,

said second spider connecting said narrow ends of said conical diaphragms to said frame.

* * * * *